

PRESS RELEASE of the Boehringer Ingelheim Foundation:

Unravelling the immune system – 2021 Heinrich Wieland Prize for Thomas Boehm

Mainz, Germany – 18 October 2021. As one of the world’s foremost immunologists, Professor Thomas Boehm has made ground-breaking contributions to the understanding of how the immune system of vertebrates develops, how it works, and has evolved over time. For his many achievements, he will receive the 2021 Heinrich Wieland Prize, endowed with 100,000 euros by the Boehringer Ingelheim Foundation. His outside-the-box thinking and innovative approaches have enabled surprising, even paradigm-shifting, insights into the function of the immune system, which reach beyond immunology.

2020 and 2021 Heinrich Wieland Prize Symposium

At Nymphenburg Palace in Munich on 21 October, Thomas Boehm, director at the Max Planck Institute of Immunobiology and Epigenetics in Freiburg, Germany, will be awarded the prize at a festive ceremony during the 2020 and 2021 Heinrich Wieland Prizes Symposium, to be held for the scientific community. This event will also include the postponed symposium and award ceremony for the 2020 Heinrich Wieland Prize, received by Professor Craig M. Crews of Yale University in New Haven, CT, for pioneering targeted protein degradation as a new principle in pharmacology.

[Link to the press release of the 2020 Heinrich Wieland Prize](#)

Journalists who wish to attend the symposium can write directly to hwp@bistiftung.de

2021 Heinrich Wieland Prize at Berlin Science Week

A second event, which will be aimed at the general public, will take place online on 2 November from 4–5 pm CET as part of Berlin Science Week. This event will be held in German and will include a discussion between the 2021 laureate Thomas Boehm and renowned philosopher Professor Markus Gabriel of the University of Bonn, Germany, about human vulnerability in the context of disease and society. For further information, visit www.boehringer-ingelheim-stiftung.de/hwp-bsw-2021

Ground-breaking discoveries by Thomas Boehm

The research of Professor Thomas Boehm has deeply influenced the contemporary understanding of the immune system and its function. “Working with such diverse systems as human cells, mice, zebrafish, and even deep-sea anglerfish, his scientific acumen and unconventional approaches have given us a detailed understanding of the immune system, especially of the role the thymus plays”, says Christoph Boehringer, chair of the Boehringer Ingelheim Foundation. The thymus, which is part of the adaptive immune system that is unique to vertebrates, learns to recognize and remember new pathogens. It can be considered as the training ground for the thymocytes, better known as T cells. In this organ, these cells learn to distinguish between the body’s own cells and invading pathogens – an ability that is necessary for it to tolerate the former and attack the latter.

Boehm's work on lampreys – primitive fish that split off from our lineage about 450 million years ago – gives us the means to look back in evolutionary time to when vertebrates first developed their adaptive immune system. As its name implies, it adapts its response to fit the attacking pathogen. Without this adaptive component of our immune system, vaccines as we know them would not be possible, as it is the component that can remember new pathogens.

Early on in his career, Boehm found a gene – Foxn1 – that regulates how cells in the inner lining of the thymus develop and organize themselves so they can teach T cells to recognize the body's own cells. "With this finding by Thomas Boehm, it was possible for the first time to use genetics in studying the mechanism of T cell development. This advance from a then-early career researcher had a significant impact on the field of immunology", says F.-Ulrich Hartl, chair of the Heinrich Wieland Prize selection committee. "It's a feat he has repeated again and again during his career – for example, by identifying general design principles of the adaptive immune system in vertebrates, finding out how the immune system influences partner choice via smell, or just recently with his discovery that deep-sea anglerfish can switch off their adaptive immune system, something that was thought to be impossible."

Details on some of Thomas Boehm's findings

Boehm's most widely published discovery is the surprising connection between the immune system and mate selection amongst vertebrates ranging from fish to humans. He found that certain molecules on the outside of our immune cells directly influence how our bodies smell and, thus, who we chose as partners. Studies looking at smell and mate selection in several species – amongst them humans – have found that partners that possess a differing set of the so-called MHC molecules (short for major histocompatibility complex) are preferred. As a larger variety of these molecules makes our immune system more versatile, it is better for vertebrates to select a mate with genes for a different set of MHC molecules and thus ensure the best possible immune system for their offspring. These astounding results established an unforeseen link between the fields of immunology and behavioural ecology.

In another surprising result, Thomas Boehm found that deep-sea anglerfish have evolved to turn off their adaptive immune system. They need to do this to avoid rejection in a double sense: They live in the deepest part of the sea, where finding a partner and holding onto it are very difficult. In an extreme adaptation to this environment, male anglerfish fuse permanently with the female. The males practically become an appendage grafted onto the female, even sharing their blood. Normally their bodies would reject the foreign tissue, but these fish evolved to turn off the adaptive immune system and with it, the ability of the immune system to distinguish the cells of its own body from those of another's. The complete uncoupling of the adaptive and the innate immune systems in this species overturns a paradigm of vertebrate immunology, which says that the two immune systems develop hand in hand. The implications of this discovery are far-reaching and not yet fully explored. They may even open new ways for safer organ transplants or reveal tools to help our immune system keep us healthy.

Academic career of Thomas Boehm

Thomas Boehm studied medicine and completed his residency in Frankfurt, Germany, in 1987. He then moved to the MRC Laboratory of Molecular Biology in Cambridge, UK. In 1991, he became professor at the University of Freiburg in

Germany, and later accepted a call to the German Cancer Research Centre (DKFZ) in Heidelberg. Since 1998, he is a Scientific Member and Director at the Max Planck Institute of Immunobiology and Epigenetics. His achievements have been widely recognized: Among others, he received the Paul Ehrlich and Ludwig Darmstaedter Prize for Young Researchers, the Gottfried Wilhelm Leibniz Prize of the DFG, the Ernst Jung Prize for Medicine, the German Immunology Award, as well as two ERC Advanced Grants. He is a member of EMBO, the German National Academy of Sciences Leopoldina, the Academy of Sciences Heidelberg, and the American Academy of Arts and Sciences.

The Heinrich Wieland Prize

This international award honours outstanding research on biologically active molecules and systems in the fields of chemistry, biochemistry, and physiology as well as their clinical importance. The 100,000-euro prize is named after the Nobel Laureate Heinrich Otto Wieland (1877–1957) and has been awarded annually since 1964. Among the awardees – selected by a scientific Board of Trustees – are four subsequent Nobel Laureates. Since 2011, the prize has been endowed by the Boehringer Ingelheim Foundation.

www.heinrich-wieland-prize.de

Boehringer Ingelheim Foundation

The Boehringer Ingelheim Foundation is an independent, non-profit organization that is committed to the promotion of the medical, biological, chemical, and pharmaceutical sciences. It was established in 1977 by Hubertus Liebrecht (1931–1991), a member of the shareholder family of the Boehringer Ingelheim company. Through its Perspectives Programme Plus 3 and its Exploration Grants, the Foundation supports independent junior group leaders. It also endows the international Heinrich Wieland Prize, as well as awards for up-and-coming scientists in Germany. In addition, the Foundation funds institutional projects in Germany, such as the Institute of Molecular Biology (IMB) in Mainz, the department of life sciences at the University of Mainz, and the European Molecular Biology Laboratory (EMBL) in Heidelberg.

www.boehringer-ingelheim-stiftung.de/en

High-resolution images are available for downloading at www.boehringer-ingelheim-stiftung.de/en

Image Thomas Boehm:

The immunologist Thomas Boehm receives the Heinrich Wieland Prize 2021 for his ground-breaking contributions to understanding the evolution of the immune system in vertebrates. Copyright: Max-Planck-Institute of Immunobiology and Epigenetics, Rockoff

This mouse thymus has been genetically altered so that cells normally situated on the inside (blue) switch places with those on the outside (green). This assists in the study of T cell (red) development. Copyright: Max-Planck-Institute of Immunobiology and Epigenetics, Krauth

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